ESI DB 877

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Halmer
PORTLAND OREGON

Instruction Sheet

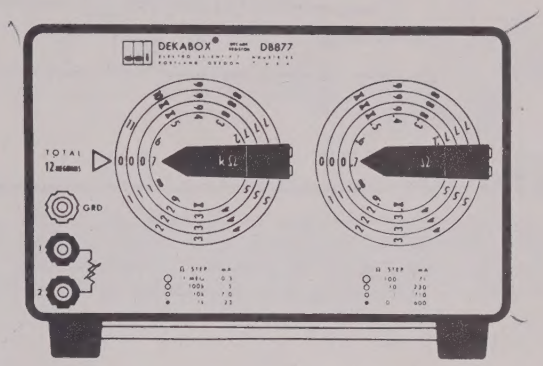
DB 877 DEKABOX® decade resistor

e|s|i®

Electro Scientific Industries

3900 N.W. SCIENCE PARK DRIVE • PORTLAND, OREGON 97229

DECEMBER 1973



description

The ESI Model DB 877 DEKABOX® is an eight-decade resistor with double coaxial-dial precision resistance elements.

specifications

Accuracy: Accuracy of resistance increments is given in the accompanying table.

Accuracy of resistance change from zero setting
Initial: ±(0.01% + 7 mΩ). 6 MOS Gr
Long-Term: ±(0.02% + 10 mΩ). 7 6 Mo2

Short-Term Switching Repeatability: 1 mΩ (typical).

Number of Decades: Eight.

Total Resistance: 12,111,111.0 Ω.

Resistance Per Decade: See table.

Smallest Step: See table.

Resistance at Zero Setting: Approximately 40 mΩ.

Breakdown Voltage: 1000 V peak to case.

Dimensions: Width 8.5 in. (21.6 cm), height 5.3 in. (13.5 cm), depth 7 in. (17.8 cm).

Weight: 5.5 lb (2.5 kg).

RATINGS PER STEP FOR EACH DECADE
Model DB 877

RESISTANCE PER DECADE (Ω)	SMALLEST STEP (Ω)	INCREMENTAL ACCURACY		COEFFICIENTS		MAXIMUM RATINGS		
		INITIAL (%)	LONG-TERM (%)	TEMPERATURE (ppm/°C)	POWER (ppm/mW/step)	POWER (mW/step)	CURRENT (mA)	VOLTAGE (V/step)
10 M	1 M	0.02	0.03	5	0.3	90	0.3	300*
1 M	100 k	0.02	0.03	5	0.3	220	1.5	150
100 k	10 k	0.02	0.03	5	0.3	500	7	71
10 k	1 k	0.02	0.03	5	0.3	500	23	23
1 k	100	0.02	0.03	5	0.3	500	71	7.1
100	10	0.03	0.03	15	0.9	500	230	2.3
10	1	0.1	0.12	20	1.2	500	710	0.71
1	0.1	1.0	1.0	60	6	250	1600	0.16

*1000 V peak maximum

warranties

WARRANTY OF QUALITY

Electro Scientific Industries, Inc. warrants its products to be free from defects in material and workmanship for the following periods:

1. Two years for components and instruments using passive circuitry. One year for repairs of out-of-warranty items.
2. One year for components and instruments using active circuitry (see ESI Metrology Catalog). Six months for repairs of out-of-warranty items.

During the in-warranty periods, we will service or, at our option, replace any device that fails in normal use to meet its published specifications. Batteries, tubes and relays that have given normal service are excepted.

WARRANTY OF TRACEABILITY

Electro Scientific Industries, Inc. maintains reference standards of measurement which are compared with the U. S. National Standards through frequent tests by the U. S. National Bureau of Standards.

ESI working standards and testing apparatus used are calibrated against the ESI reference standards in a rigorously maintained program of measurement control.

The manufacture and final calibration of all ESI instruments are controlled by use of the ESI reference and working standards and testing apparatus in accordance with established procedures and documented results. (Reference MIL-C-45662)

Final calibration of this instrument was performed with reference to the mean values of the ESI reference standards or to ratio devices that were verified at the time and place of use.

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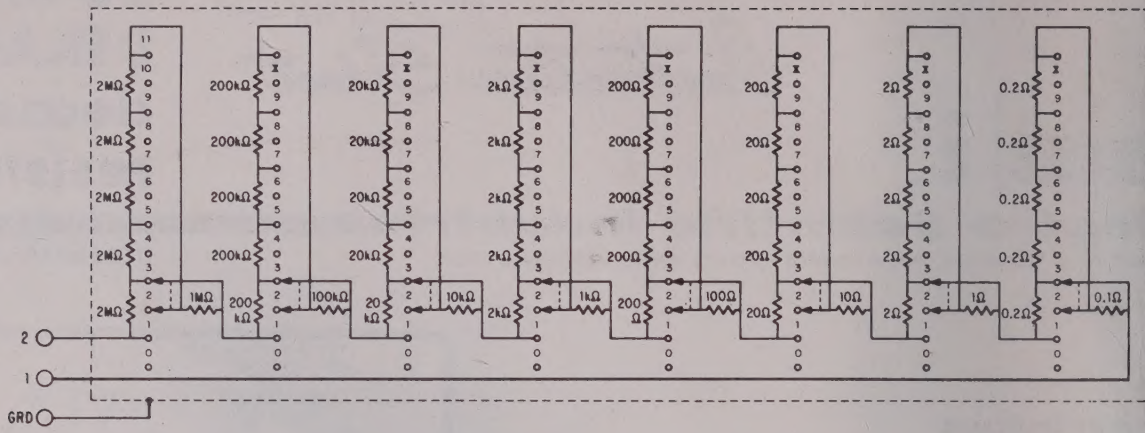
esi Part No. 19199

circuit diagram

Resistor values approximate - see parts list



operation

Three binding posts are provided on the front panel of the DEKABOX. The GRD binding post is connected to the metal case which forms a shield for the instrument. The resistance between the other two binding posts corresponds to the setting of the coaxial dials, which are arranged to read resistance directly in ohms.

All dials can be turned through a complete circle, which allows settings to be changed rapidly and directly from X to 0. All dials except the first have an X position which corresponds to ten steps on the dial or one step of the next higher dial. The first dial has 12 positions, 0 through 11, which allow a total resistance of more than 12 times the step resistance of the first dial.

calibration

To calibrate the instrument, measure each resistor with a resistance bridge of 0.01% accuracy or better. ESI Models 231, 232 and 242 Resistance Measuring Systems are recommended for this use. The procedure is as follows:

1. Set all dials to 0, measure and record zero resistance.
2. Set each dial to 1, 2, 4, 6, 8, and X in turn and measure the resistance at each setting with all other dials set to 0.
3. Subtract the zero resistance from each measured resistance less than 1 kilohm.

maintenance

Periodic maintenance of DEKABOXES is neither required nor recommended. The switches are lubricated at the time of manufacture and should be cleaned or lubricated only if they are not making good electrical contact. A switch lubrication kit (ESI Part No. 1343) is available for this purpose.

parts list

The following table lists replacement parts alphabetically by name of part. All parts listed are available from Electro Scientific Industries and must be ordered from the factory. When ordering include the following information:

Model and serial number of the instrument
ESI part number and description of part

Federal Supply Code for Manufacturers (FSCM) for Electro Scientific Industries, Inc. is 11837.

DESCRIPTION	ESI PART NO.	QTY USED
Cap, Binding Post, Black	1170	2
Cap, Binding Post, Gold Plated	1172	1
Cap, Binding Post, Gray	1476	2
Resistor Switch Assembly, 0.1Ω/step -including-	4937	1
Resistor, 0.0992Ω	4939	1
Resistor, 0.1992Ω	4938	5
Switch Section	73041	1
Resistor Switch Assembly, 1Ω/step -including-	4899	1
Resistor, 0.9992Ω	4901	1
Resistor, 1.9992Ω	4900	5
Switch Section	73041	1
Resistor Switch Assembly, 10Ω/step -including-	4893	1
Resistor, 9.9992Ω	4895	1
Resistor, 19.9992Ω	4894	5
Switch Section	73041	1
Resistor Switch Assembly, 100Ω/step -including-	4888	1
Resistor, 100Ω	4890	1
Resistor, 200Ω	4889	5
Switch Section	73041	1
Resistor Switch Assembly, 1kΩ/step -including-	4882	1
Resistor, 1kΩ	4884	1
Resistor, 2kΩ	4883	5
Switch Section	73041	1
Resistor Switch Assembly, 10kΩ/step -including-	4902	1
Resistor, 10kΩ	4904	1
Resistor, 20kΩ	4903	5
Switch Section	73041	1
Resistor Switch Assembly, 100kΩ/step -including-	4905	1
Resistor, 100kΩ, Bobbin	4907	1
Resistor, 200kΩ, Bobbin	4906	5
Switch Section	73041	1
Resistor Switch Assembly, 1MΩ/step -including-	4958	1
Resistor, 1MΩ, Bobbin	5393	1
Resistor, 2MΩ, Bobbin	5394	5
Switch Section	73041	1

U.S. Patents 2,786,122 and 3,150,634.

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NEW VALUE

Would you like more information?

old NEW VALUE
4890 73091 100Ω
4889 73090 200Ω
4894 73092 20K
4895 73093 10Ω
4901 73095 1Ω
4900 73094 2Ω

73028 200K
73099 200K
73096 20K
73097 10K
73088 2K

ESI technical publications are listed on the back of this page. If you would like any of these, simply check the appropriate box and fill in your address below. Also, please add any comments you have concerning the instrument or instruction manual. We value your feedback to help us improve or correct our manuals.

Instrument Description: Model No. _____ Serial No. _____
(Please Print)

Name _____ Title _____

Department _____ Mail Stop _____

Company _____

Address _____

City _____ State _____ Zip Code _____

Comments or corrections _____

_____

_____

_____

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Mail this page to:

Electro Scientific Industries, Inc.

13900 N.W. Science Park Drive
Portland, Oregon 97229

Attention: Literature Department

- applications data
- technical articles
- engineering bulletins

☐ EB10 Effects of Output Loading on Resistive Voltage Dividers, *October 1969*

☐ EB15 Low Input Resistance Voltage Dividers, *February 1970*

☐ EB17' Accuracy vs. Frequency of Models 290B and 250DE Universal Impedance Bridges, *(revised May 1969)*

☐ EB26 International System of Units, *August 1969*

☐ EB29 DC and Low Frequency AC Ratio Measurements, *Dr. Merle L. Morgan, September 1962*

☐ EB30 Traceability of Resistance Measurement, *Jack Riley, January 1964*

☐ EB34 Resistance Transfer Technique, *Lawrence H. White, (revised April 1968)*

☐ EB35 An Improved Technique for Establishing Resistance Ratios, *R. M. Pailthorp and J. C. Riley, November 1962*

☐ EB41 Derivation of Electrical Units from Fundamental Standards, *R. D. Kuykendall and R. M. Pailthorp, July 1964*

☐ EB44 DC measurements Using Ratio Techniques, *Jack C. Riley, September 1965*

☐ TA2 A Ratio Transformer Bridge for Standardization of Inductors and Capacitors, *D. L. Hillhouse and H. W. Kline, August 1960*

☐ TA6 The Accuracy of Series and Parallel Connections of Four-Terminal Resistors, *Jack C. Riley, April 1965*

☐ TA8 AC Measurements Using Ratio Techniques, *Jack C. Riley, May 1965*

☐ TA14 The Advantages of a Ten Kilohm Transportable Resistance Standard, *Robert M. Pailthorp, September 1967*

☐ TA16 Which Bridge for Precise Resistance Measurements? *Edward J. Swenson and George D. Vincent, December 1967*

☐ TA17 Experimental Verification of the Five-Terminal, Ten-Kilohm Resistor as a Device for Dissemination of the Ohm, *R. M. Pailthorp and George Vincent, December 1968*

☐ TA22A Laser Resistance Trimming from the Measurement Point of View, *Arthur G. Albin and Edward J. Swenson, June 1971*

☐ TA23 Precision Measurement of Resistor Networks, *Robert M. Pailthorp and Jack C. Riley, June 1971*

☐ TA24 Predictive Adjustment of Tantalum Film Resistors by Anodization, *Donald R. Cutler and Edward J. Swenson, July 1971*

☐ TA25 Laser Trimming Analysis Using a Resistive Sheet Analogy, *Swenson, Vincent, Riley, December 1972*

☐ TA26 The Effects of Laser Trimming on Birox and 1100 Series Thick Film Composition, *N. S. Spann, R. Headley, G. D. Vincent and E. J. Swenson, October 1971*

☐ TA27 Laser Trimming Thin Film Precision Resistor Networks with an Automated System, *Leonhard Groth, January 1974*

☐ TA28 YAG Laser Trimming of Thick Film Resistors, *Headley, Popowich, Anders, January 1974*

☐ TA31 A Method of Obtaining Optimum Trimming Performance from a Laser System, *Paul F. Parks and Thomas W. Richardson, October 1974*

☐ TA32 Laser Trimming RC Active Filters, *Edward J. Swenson, April 1978*

☐ TA33 Reducing Post Trim Drift of Thin Film Resistors By Optimizing YAG Laser Output Characteristics, *June 1978*

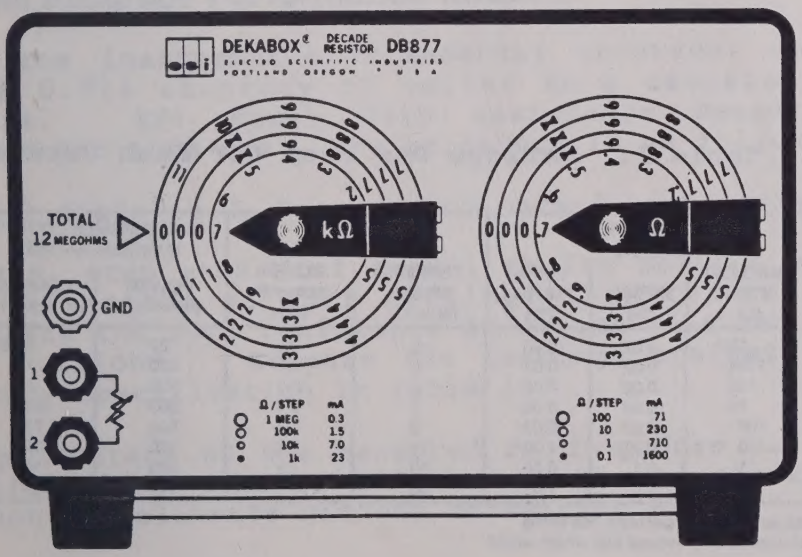
MODEL DB877 DEKABOX™ DECADE RESISTOR

ntroduction

Model DB877 DEKABOX Decade Resistor is designed to provide long-term dependable service in precision DC and audio frequency applications. Eight decades of precision fixed resistors are mounted in an extruded metal case for shielding and mechanical protection. A case-connected ground terminal and two input terminals are conveniently located on the front of each unit.

Featured is the ESI®-patented DEKADIAL coaxial dial arrangement which provides up to 120 million divisions of resolution. It allows first, coarse approximation and then progressively finer steps to arrive at an exact resistance value. The dials turn independently through 360 degrees of rotation. A special detent design facilitates dial location.

Accuracy over a wide range of ambient conditions is assured by the use of resistors exhibiting low temperature and power coefficients. A single continuous filament winding on a thin mica card is used wherever possible. For high-resistance values, a non-inductive winding on a ceramic bobbin is used. Switches with multiple contacts of solid silver-alloy provide low, stable contact resistance, and the ceramic switch wafers are treated with silicone to further improve their insulating qualities.



Model DB877

Specifications

CHARACTERISTIC	SPECIFICATION
Accuracy	
Resistance Increments	See Table 1
Initial	(0.01% + 7 milliohms)
Long-term	(0.02% + 10 milliohms)
Short-term Switching Repeatability	1 milliohm (typical)
Number of Decades	Eight
Total Resistance	12.111111 megohms
Resistance per Decade	See Table 1
Smallest Step	0.1 ohm
Resistance at Zero Setting	Approximately 40 milliohms
Breakdown Voltage	1000 volts peak to case
Dimensions	Height 5.9 in. (15.0 cm) Width 8.5 in. (21.6 cm) Depth 6.5 in. (16.5 cm)
Weight	7.5 lbs (3.4 kg) net

Table 1. Ratings Per Step for Each Decade

RESISTANCE PER DECADE (Ω)	INCREMENTAL ACCURACY			COEFFICIENTS		MEASUREMENT DUTY* MAXIMUM RATINGS		PEAK VOLTAGE (V/step)
	SMALLEST STEP (Ω)	INITIAL (%)	LONG-TERM (%)	TEMPERATURE (ppm/°C)	POWER (ppm/mW/step)	POWER (mW/step)	CURRENT (mA)	
11M	1M	0.02	0.03	5	0.3	22	0.15	300
1M	100k	0.02	0.03	5	0.3	220	1.5	300
100k	10k	0.02	0.03	5	0.3	500	7	
10k	1k	0.02	0.03	5	0.3	500	23	
1k	100	0.02	0.03	5	0.3	500	71	
100	10	0.03	0.03	15	0.9	500	230	
10	1	0.1	0.12	20	1.2	500	710	
1	0.1	1.0	1.0	60	6	250	1600	

*Intermittent use such that temperature rise of the resistor will not appreciably exceed that which would occur in free air.

Operation

Three binding posts are provided on the front panel of the DEKABOX. The GND binding post is connected to the metal case which forms a shield for the instrument. The resistance between the other two binding posts corresponds to the setting of the coaxial dials, which are arranged to read resistance directly in ohms.

All decade dials can be turned 360°, which allows settings to be changed rapidly and directly from X to 0. Seven of the decade dials (0.1 ohm - 100 kilohms) have an X position that corresponds to ten steps on the dial or one step of the next higher decade dial. The total resistance for the seven decade dials is 1.111111 megohms. The eighth decade dial (1 megohm) has 12 positions, 0 through 11 for a total resistance of 11.0 megohms.

Maintenance

Periodic maintenance of DEKABOXES is neither required nor recommended. The switches are lubricated at the time of manufacture and should be cleaned or lubricated only if they are not making good electrical contact. Consult ESI before attempting to lubricate.

Incremental Accuracy Performance Check

To check the instrument's incremental accuracy, use a resistance bridge of 0.01% accuracy or better in a temperature controlled environment. ESI Model 242D Resistance Measuring System is recommended for this use. The procedure is as follows:

1. Set all dials to 0, measure and record zero resistance.

2. In turn, step each dial from 1 to its maximum setting, measure the resistance at each setting, then return the dial to 0. (Subtract the zero resistance from each measured resistance less than 1 kilohm.) Compare the readings against the incremental accuracy specification in Table 1.

3. If the acuracy of the measured reading does not meet its rated specification, consult ESI for further instructions. Do not attempt to calibrate without consulting ESI.

Parts List

Table 2 lists replacement parts. All parts listed are only avail-able from ESI and must be ordered from the factory. When orderin please include the model number and serial number of the instrumen along with the ESI part number and description of part.

Federal Supply Code for Manufacturers (FSCM) for Electro Scientifi Industries, Inc. is 11837.

Table 2. DB877 Parts List

DESCRIPTION	ESI PART NO.	QTY USED
Cap, Binding Post, Black	1170	2
Cap, Binding Post, Gray	1476	2
Cap, Binding Post, Gold Plated	1172	1
Resistor Switch Assembly, 0.1 ohm/step	4937	1
-including-		
Resistor, 0.0992 ohm	73101	1
Resistor, 0.1992 ohm	73100	5
Switch Section	73041	1
Resistor Switch Assembly, 1 ohm/step	4899	1
-including-		
Resistor, 0.0992 ohm	73095	1
Resistor, 1.9992 ohms	73094	5
Switch Section	73041	1
Resistor Switch Assembly, 10 ohms/step	4893	1
-including-		
Resistor, 9.9992 ohms	73093	1
Resistor, 19.9992 ohms	73092	5
Switch Section	73041	1
Resistor Switch Assembly, 100 ohms/step	4888	1
-including-		
Resistor, 100 ohms	73091	1
Resistor, 200 ohms	73090	5
Switch Section	73041	1
Resistor Switch Assembly, 1 kilohm/step	4882	1
-including-		
Resistor, 1 kilohm	73089	1
Resistor, 2 kilohms	73088	5
Switch Section	73041	1
Resistor Switch Assembly, 10 kilohms/step	4902	1
-including-		
Resistor, 10 kilohms	73097	1
Resistor, 20 kilohms	73096	5
Switch Section	73041	1
Resistor Switch Assembly, 100 kilohms/step	4905	1
-including-		
Resistor, 100 kilohms, Bobbin	21936	1
Resistor, 200 kilohms, Bobbin	21935	5
Switch Section	73041	1
Resistor Switch Assembly, 1 megohm/step	4958	1
-including-		
Resistor, 1 megohm, Bobbin	5393	1
Resistor, 2 megohms, Bobbin	5394	5
Switch Section	73041	1

Warranty of Quality

Electro Scientific Industries, Inc. warrants its products to be free from defects in material and workmanship. Rigorous quality control permits the following standard new equipment warranties:

1. Two years for components and instruments utilizing passive circuitry.

2. One year on components and instruments utilizing active circuitry. One year on test fixtures.

During the in-warranty periods, we will service or, at our option, replace, at the factory, any device that fails in normal use to meet its published specifications. Batteries, tubes and relays that have given normal service are excepted.

Warranty of Traceability

The reference standards of measurement of Electro Scientific Industries, Inc., are compared with the U.S. National Standards through frequent tests by the U.S. National Bureau of Standards. The ESI working standards and testing apparatus used are calibrated against the reference standards in a rigorously maintained program of measurement control.

The manufacture and final calibration of all ESI instruments are controlled by use of the ESI reference and working standards and testing apparatus in accordance with established procedures and documented results. (Reference MIL-C-45662)

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Where ESI product will interconnect with components not supplied by ESI, ESI does not warrant the ESI product against failures caused by mismatch of the non-ESI component to the ESI product nor will ESI be liable for damages to the non-ESI component resulting from mismatch.

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